

	Type	L #	Hits	Search Text	DBs	Time Stamp
1	BRS	L1	1553	(ruthenium or Ru) near4 (gas or precursor or reactant)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18
2	BRS	L2	1735	(ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18
3	BRS	L3	3535	(bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. 4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") ))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18
4	BRS	L4	266646	"O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3"	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18

	Type	L #	Hits	Search Text	DBs	Time Stamp
5	BRS	L5	51	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3))) same ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18

	Type	L #	Hits	Search Text	DBs	Time Stamp
6	BRS	L6	232	(((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. 4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same ("O.sub.2" or "N.sub.20" or "H.sub.20" or "NO.sub.2" or "O.sub.3")	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18
7	BRS	L7	661200	(capacitor\$3 or DRAM or (dynamic adj random adj access adj memory) or SDRAM)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18

	Type	L #	Hits	Search Text	DBs	Time Stamp
8	BRS	L8	5188	((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:18
9	BRS	L9	125468 3	("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
10	BRS	L10	331	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) near8 (stop\$4 or terminat\$4 or end\$4 or reduc\$4 or slow\$4 or paus\$4 or cycl\$4 or puls\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
11	BRS	L11	838	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. 4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same (("O.sub.2" or "N.sub.20" or "H.sub.20" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
12	BRS	L12	5188	((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19
13	BRS	L13	125468 3	("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
14	BRS	L14	9	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.190.sub.2") )))) near8 (absorp\$6 or adsorb\$6) near8 ("O.sub.2" or "N.sub.20" or "H.sub.20" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19



	Type	L #	Hits	Search Text	DBs	Time Stamp
15	BRS	L15	331	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) near8 (stop\$4 or terminat\$4 or end\$4 or reduc\$4 or slow\$4 or paus\$4 or cycl\$4 or puls\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
16	BRS	L16	69	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) near8 (stop\$4 or terminat\$4 or end\$4 or reduc\$4 or slow\$4 or paus\$4 or cycl\$4 or puls\$4) same ("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2"	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
17	BRS	L17	430	(("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4)) near8 (((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") ))))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
18	BRS	L18	358	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) near8 ("H.sub.2" or hydrogen)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
19	BRS	L19	48	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) near8 ("H.sub.2" or hydrogen) near8 (anneal\$4 or reduc\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
20	BRS	L20	48	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.190.sub.2") )))) same (absorp\$6 or adsorb\$6) same ("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM-TD B	2004/10/13 12:19

	Type	L #	Hits	Search Text	DBs	Time Stamp
21	BRS	L22	1026	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same (stop\$4 or terminat\$4 or end\$4 or reduc\$4 or slow\$4 or paus\$4 or cycl\$4 or puls\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
22	BRS	L23	101	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same ("H.sub.2" or hydrogen) near8 (anneal\$4 or reduc\$4)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20



	Type	L #	Hits	Search Text	DBs	Time Stamp
23	BRS	L24	838	((("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4)) same (((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") ))))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TDB	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
24	BRS	L25	45	(((ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3))) same ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") ))) ) and (capacitor\$3 or DRAM or (dynamic adj random adj access adj memory) or SDRAM)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
25	BRS	L26	157	((((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same ("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2" or "O.sub.3")) and ((capacitor\$3 or DRAM or (dynamic adj random adj access adj memory) or SDRAM))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
26	BRS	L27	18	((((ruthenium or Ru) near4 (gas\$3 or precursor\$3, or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same ("O.sub.2" or "N.sub.20" or "H.sub.20" or "NO.sub.2" or "O.sub.3")) and ((capacitor\$3 or DRAM or (dynamic adj random adj access adj memory) or SDRAM))) and @py<2001	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
27	BRS	L28	36	((((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. b.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) same ("O.sub.2" or "N.sub.20" or "H.sub.20" or "NO.sub.2" or "O.sub.3")) and ((capacitor\$3 or DRAM or (dynamic adj random adj access adj memory) or SDRAM))) and @py<=2001	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
28	BRS	L30	430	(( (ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub. 4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2") )))) near8 (("O.sub.2" or "N.sub.20" or "H.sub.20" or "NO.sub.2" or "O.sub.3") or (oxygen or oxidiz\$4 or oxidat\$4))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20
29	IS&R	L31	2	("6297122").PN.	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20
30	IS&R	L32	2	("6617248").PN.	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:20

	Type	L #	Hits	Search Text	DBs	Time Stamp
31	BRS	L33	69	((('ruthenium or Ru) near4 (gas or precursor or reactant)) or ((ruthenium or Ru) near4 (gas\$3 or precursor\$3 or reactant\$3)) or ((bis-cyclopentadienyl or bis-methylcyclopentadienyl or bis-ethylcyclopentadienyl or tris-dipivaloylmethanate or (bis adj cyclopentadienyl) or (bis adj methylcyclopentadienyl) or (bis adj ethylcyclopentadienyl) or (tris adj dipivaloylmethanate) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("CH.sub.3C.sub.5H.sub.4")) or (Ru near2 ("C.sub.2H.sub.5C.sub.5H.sub.4")) or (Ru near2 ("C.sub.22H.sub.19O.sub.2"))))) near8 (stop\$4 or terminat\$4 or end\$4 or reduc\$4 or slow\$4 or paus\$4 or cycl\$4 or puls\$4)) same (("O.sub.2" or "N.sub.2O" or "H.sub.2O" or "NO.sub.2"	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:36
32	BRS	L34	665	4 and 2	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:36
33	BRS	L35	466	34 and ((@ad<20010131) or (@rlad<20010131))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2004/10/13 12:37

DOCUMENT-IDENTIFIER: US 20010031527 A1

TITLE: Semiconductor memory device  
incorporating therein ruthenium electrode and method for  
the manufacture thereof

----- KWIC -----

Pre-Grant Publication Year - PGPY (1):

2001

Summary of Invention Paragraph - BSTX (4):

[0002] As is well known, a dynamic random access memory (DRAM) with at least one memory cell comprised of a transistor and a capacitor has a higher degree of integration mainly by down-sizing through micronization. However, there is still a demand for downsizing the area of the memory cell.

Summary of Invention Paragraph - BSTX (5):

[0003] To meet the demand, therefore, there have been proposed several methods, such as a trench type or a stack type capacitor, which is arranged three-dimensionally in a memory device to reduce the cell area available to the capacitor. However, the process of manufacturing three-dimensionally arranged capacitor is a long and tedious one and consequently involves high manufacturing cost. Therefore, there is a strong demand for a new memory device that can reduce the cell area with securing a requisite volume of information without requiring complex manufacturing steps.

Summary of Invention Paragraph - BSTX (6):

[0004] In attempt to meet the demand, DRAM device



employs a high dielectric material as a capacitor thin film such as barium strontium titanate (BST) and tantalum oxide (Ta.sub.2O.sub.5). Meanwhile, ferroelectric random access memory (FeRAM) employs a ferroelectric material as a capacitor thin film such as strontium bithmuth tantalate (SBT) and lead zirconate titanate (PZT) in place of a conventional silicon oxide film or a silicon nitride film.

Summary of Invention Paragraph - BSTX (7):

[0005] However, even if the high dielectric material is used as the capacitor thin film, it has still a problem that an increase of a capacitance has a limitation by using a conventional method for forming the stack or the trench capacitor structure.

Detail Description Paragraph - DETX (2):

[0015] There are provided in FIGS. 1 and 2A to 2C a cross sectional view of a semiconductor device 100 incorporated therein a trench type capacitor and cross sectional views setting forth a method for the manufacture thereof in accordance with a preferred embodiment of the present invention. It should be noted that like parts appearing in FIGS. 1 and 2A to 2C are represented by like reference numerals.

Detail Description Paragraph - DETX (9):

[0022] In a next step as shown in FIG. 2C, a second Ru layer 132 with a rough surface is formed on the first Ru layer 130 by using a thermal chemical vapor deposition (TCVD) technique, thereby obtaining a Ru electrode structure 140. Like a conventional hemispherical grain silicon (HSGs), the second Ru layer 132 has a rugged surface of hemispherical grain so that a surface area of

the electrode increases and a capacitance increases. Here, the TCVD is performed on a condition that used gas is Ru (C.sub.5H.sub.5).sub.2/O.sub.2, a temperature ranges from approximately 200 to approximately 400 and a pressure ranges from approximately 40 mTorr to approximately 200 mTorr. In order to form the rugged surface of the second Ru layer 132, the deposition temperature should be low because it is difficult to grow up nuclei of the Ru at the low temperature. Additionally, roughness of the Ru surface is varied by means of oxygen content in the second Ru layer 132.

Detail Description Paragraph - DETX (10):

[0023] Referring to FIGS. 3 and 4A to 4D, there are provided cross sectional view of a semiconductor device 200 incorporated therein a stack type capacitor and cross sectional views setting forth a method for the manufacture thereof in accordance with another preferred embodiment of the present invention. It should be noted that like parts appearing in FIGS. 3 and 4A to 4D are represented by like reference numerals.

Detail Description Paragraph - DETX (18):

[0031] Finally, a second Ru layer 232 with a rough surface is formed on the patterned Ru layer 230A by using a thermal chemical vapor deposition (TCVD) technique, thereby obtaining a Ru electrode structure 240 as shown in FIG. 4D. The TCVD is performed on a condition that used gas is Ru (C.sub.5H.sub.5).sub.2/O.sub.2, a temperature ranges from approximately 200 to approximately 400 and a pressure ranges from approximately 40 mTorr to approximately 200 mTorr. In order to form the rugged surface of the second Ru layer 232, the deposition temperature should be low because it is difficult to grow up nuclei of the Ru at the low temperature.

Claims Text - CLTX (6):

5. The semiconductor device as recited in claim 1, wherein a capacitor structure of the semiconductor device is a trench type.

Claims Text - CLTX (7):

6. The semiconductor device as recited in claim 1, wherein a capacitor structure of the semiconductor device is a stack type.

Claims Text - CLTX (12):

11. The method as recited in claim 7, wherein the step c) is carried using a gas of Ru(C.sub.5H.sub.5).sub.2/O.sub.2.

Claims Text - CLTX (14):

13. The method as recited in claim 7, wherein a capacitor structure of the semiconductor device is a trench type.

Claims Text - CLTX (15):

14. The method as recited in claim 7, wherein a capacitor structure of the semiconductor device is a stack type.

US-PAT-NO: 6287934

DOCUMENT-IDENTIFIER: US 6287934 B1

TITLE: Capacitor structure of semiconductor  
memory cell and  
method for fabricating capacitor  
structure of  
semiconductor cell

----- KWIC -----

Abstract Text - ABTX (1):

A capacitor structure in a semiconductor memory cell includes a lower electrode formed on a base body, a capacitor insulation film which is a ferroelectric thin film formed on the lower electrode, and an upper electrode formed on the capacitor insulation film. The lower electrode is shaped semi-spherical. The capacitor structure has an increased area of the upper electrode in contact with the ferroelectric thin film, local concentration of an electric field in the ferroelectric thin film is unlikely to occur.

TITLE - TI (1):

Capacitor structure of semiconductor memory cell and  
method for fabricating  
capacitor structure of semiconductor cell

YEAR ISSUED - PY (1):

2001

Brief Summary Text - BSTX (3):

This invention relates to a capacitor structure in a semiconductor memory cell using a ferroelectric thin film and a method for fabricating such a

electrode layer, and a  
capacitor insulation film made of the ferroelectric film;  
and

Brief Summary Text - BSTX (38):

In the method for fabricating a capacitor structure in a semiconductor memory cell according to the third or fourth aspect of the invention, in the step (a) of forming the base layer, an upper portion of the base body not covered by the base layer is preferably removed. It leads to a more increase in the capacitor effective area, and hence a more increase in the amount of stored charge. The base layer may be an insulation material layer or a conductive material layer. If the base layer is a conduction material layer, it may be a barrier metal layer, or may be an upper end of a contact plug extending from a source/drain region of a select transistor formed under the capacitor structure.

Brief Summary Text - BSTX (44):

The lower electrode (lower electrode layer) and/or the upper electrode (electrode thin film) in the capacitor structure of the semiconductor memory cell according to the invention may be made of, for example,  $\text{RuC.sub.2}$ ,  $\text{IrO.sub.2}$ , layered  $\text{RuO.sub.2}$  /Ru, Pt, Pd, layered Pt/Ti, layered of Pt/Ta, layered Pt/TiTa,  $\text{La.sub.0.5 Sr.sub.0.5 CoO.sub.3}$  (LSCO), layered Pt/LSCO, or  $\text{YBa.sub.2 Cu.sub.3 O.sub.7}$ . In multi-layered films shown above, materials appearing left of "/" form a layer adjacent the ferroelectric thin film whereas materials appearing right of "/" form a layer adjacent the base body or a plate line. The upper electrode may commonly form the plate line, or a separate plate line other than the upper electrode may be formed. Usable for making the

upper electrode layer and the electrode thin film are sputtering or pulse laser ablation. Usable for patterning the lower electrode layer and the electrode thin film is, for example, ion milling or RIE.

Brief Summary Text - BSTX (46):

The semiconductor memory cell having the capacitor structure according to the invention may be a nonvolatile memory cell (so-called FERAM) or DRAM.

Drawing Description Text - DRTX (5):

FIG. 4 is a schematic fragmentary cross-sectional view of a capacitor structure in a semiconductor memory cell according to the first embodiment of the invention;

Drawing Description Text - DRTX (6):

FIGS. 5A and 5B are schematic fragmentary cross-sectional views of a semiconductor substrate and other elements for explaining a method for fabricating a capacitor structure of a semiconductor memory cell according to the first embodiment of the invention;

Drawing Description Text - DRTX (7):

FIGS. 6A and 6B are schematic fragmentary cross-sectional views of the semiconductor substrate and other elements for explaining the method for fabricating the capacitor structure of the semiconductor memory cell, subsequent to FIGS. 5A and 5B;

Drawing Description Text - DRTX (8):

FIG. 7 is a schematic fragmentary cross-sectional view of a capacitor structure of a semiconductor memory cell as a modified version of the first embodiment;

Drawing Description Text - DRTX (9):

FIG. 8 is a schematic fragmentary cross-sectional view of a semi-processed configuration of a capacitor structure of a semiconductor memory cell according to the first embodiment of the invention;

Drawing Description Text - DRTX (10):

FIG. 9 is a schematic fragmentary cross-sectional view of the capacitor structure of the semiconductor memory cell according to the second embodiment of the invention;

Drawing Description Text - DRTX (11):

FIG. 10 is a schematic fragmentary cross-sectional view of a capacitor structure of a semiconductor memory cell according to the fourth embodiment of the invention;

Drawing Description Text - DRTX (12):

FIG. 11 is a schematic fragmentary cross-sectional view of the capacitor structure of the semiconductor memory cell according to the fourth embodiment of the invention;

Drawing Description Text - DRTX (13):

FIG. 12 is a schematic fragmentary cross-sectional view of a capacitor structure of a semiconductor memory cell according to the fifth embodiment of the invention;

Drawing Description Text - DRTX (14):

FIG. 13 is a schematic fragmentary cross-sectional view of a capacitor structure of a semiconductor memory cell according to the sixth embodiment of the invention;

Detailed Description Text - DETX (53):

Subsequently, DC sputtering is performed using Ru (ruthenium) as the and O.sub.2 /Ar as the process gas to form the lower electrode layer 21A made of RuO.sub.2 on the entire surface involving the insulation material layer 40. The lower electrode layer 21A is then dry-etched by RIE using O.sub.2 /Cl.sub.2. In this manner, the semi-spherical insulation material layer 40 made of SiN, and the lower electrode made of the lower electrode layer 21A stacked on the insulation material layer 40, can be obtained. Note here that dry-etching of the lower electrode layer 21A is conducted for patterning the lower electrode layer 21A, and not for shaping the lower electrode layer 21 semi-spherical. The surface of the lower electrode layer 21A on which the ferroelectric thin film should be made is covered by the resist material during etching of the lower electrode layer 21A. Therefore, the ferroelectric thin film can be formed on the lower electrode layer 21A maintaining its original surface condition, and deterioration in P-E hysteresis loop characteristics of the ferroelectric thin film can be prevented.

Detailed Description Text - DETX (54):

The structure of the lower electrode explained with the fifth embodiment is applicable to the lower electrode of the capacitor structure of the semiconductor memory explained with either the second or fourth embodiment. Moreover, the method for fabricating the capacitor structure of the semiconductor memory cell explained with the third embodiment can be used for fabricating the lower electrode structure explained with the fifth embodiment. Additionally, a barrier metal layer may be formed between the lower electrode



US-PAT-NO: 6281125

DOCUMENT-IDENTIFIER: US 6281125 B1

TITLE: Methods for preparing ruthenium  
oxide films

----- KWIC -----

YEAR ISSUED - PY (1):

2001

Brief Summary Text - BSTX (5):

Thus, films of ruthenium and oxides thereof have suitable properties for a variety of uses in integrated circuits. For example, they can be used in integrated circuits for electrical contacts. They are particularly suitable for use as barrier layers between the dielectric material and the silicon substrate in memory devices, such as ferroelectric memories. Furthermore, they may even be suitable as the plate (i.e., electrode) itself in capacitors.

Detailed Description Text - DETX (7):

The precursor composition can be vaporized in the presence of one or more reaction gases and optionally one or more inert carrier gases to form a ruthenium oxide film. The inert carrier gas is typically selected from the group consisting of nitrogen, helium, argon, and mixtures thereof. In the context of the present invention, an inert carrier gas is one that is generally unreactive with the complexes described herein and does not interfere with the formation of a ruthenium oxide film. The reaction gas can be selected from a wide variety of oxidizing gases reactive with the complexes

described herein,  
at least at a surface under the conditions of chemical  
vapor deposition.  
Examples of oxidizing gases include O.sub.2, N.sub.2 O,  
O.sub.3, NO, NO.sub.2,  
H.sub.2 O.sub.2, and H.sub.2 O. Various combinations of  
reaction gases and  
optional carrier gases can be used in the methods of the  
present invention to  
form films.

Detailed Description Text - DETX (18):

The use of the complexes and methods of forming films of  
the present  
invention are beneficial for a wide variety of thin film  
applications in  
semiconductor structures, particularly those requiring  
diffusion barriers. For  
example, such applications include capacitors and  
metallization layers, such as  
multilevel interconnects in an integrated circuit  
structure. Such structures  
are described, for example, in Applicants' Assignees'  
copending patent  
application entitled "Ruthenium Silicide Diffusion Barrier  
Layers and Methods  
of Forming Same," having Ser. No. 09/141,240, dated Aug.  
27, 1998, and filed  
on even date herewith now U.S. Pat. No. 6,197,628.